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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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08/992,767 12/17/97 YOKOYAMA

H NEC-19654

EXAMINER

MMC2/0108

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WILLIAMS, D.

ART UNIT

PAPER NUMBER

2814

DATE MAILED:

01/08/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

# Office Action Summary

Application No.

08/992,767

Applicant(s)

YOKOYAMA, HIROAKI

Examiner

Douglas A Wille

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 30 November 2000.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-10 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

## Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 18) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1 and 3 – 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsoi et al. in view of Roberts et al., McDavid, Miller et al. and Kim et al.

3. With respect to claims 1, 4 and 8, Tsoi et al. show that for semiconductor devices it is necessary to form different sized vias for contacts (see cover Figure) but do not discuss coverage problems. Roberts et al. show the formation of metallized vias (see cover Figure and column 4, line 37 et seq.) where an upper metal layer is redeposited to form both a fluted upper area and a corner filling lower area where the corner filling is much less than half the thickness of the insulation layer. This technique provides improved step coverage (see abstract). The Roberts et al. technique depends upon having an upper metal layer which is redistributed into the corners of the via and is directed toward vias with a 2:1 aspect ratio (column 5, line 40). McDavid shows a technique of forming a metallization in a via (see cover Figure and column 2, line 18 et seq.) where the corner filling 13 is formed by anisotropically etching a preliminary metal layer. It would have been obvious to modify the Roberts et al. technique to form the corner filling using the McDavid method so that it is not necessary to maintain an upper metal layer and to apply this technique to Tsoi et al. to improve step coverage. Kim et al. show a method of forming metallization in a via (see cover Figure and column 4, line 8 et seq.) where the upper surface of

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the via is wider, which effectively reduces the aspect ratio (column 1, line 62). Note that Roberts et al. also show the fluted upper area of the via. It would have been obvious to specifically include this feature to reduce the aspect ratio and thus improve coverage. While Tsoi et al. do not specify the aspect ratio of the vias it would be expected that, in practice, it would be desirable to form vias without concern for the aspect ratio. Miller et al. show the formation of a metallized via (see cover Figure and column 5, line 22) for high aspect ratio holes (column 2, line 43). It would have been obvious to use the use the method shown above for the low aspect ratio holes and to use the Miller et al. technique for the high aspect ratio holes and to use the fluted upper area of the hole as shown by Kim et al. for all the holes.

4. With respect to claims 5, 6, 9 and 10 Roberts et al. show that the corner filling is a small fraction of the thickness of the insulation layer and could obviously accommodate any particular ratio that is desired.

5. With respect to claims 3 and 7, McDavid shows that the metal could be Mo or W (column 2, line 36). It would have been obvious to use a refractory metal as shown since it is known to be functional for this application.

### ***Conclusions***

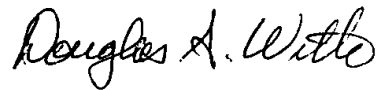
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas A Wille whose telephone number is (703) 308-4949. The examiner can normally be reached on M-F (6:15-3:45).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the

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organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A handwritten signature in black ink that reads "Douglas A. Wille". The signature is written in a cursive, flowing style.

Douglas A. Wille  
Patent Examiner

DAW  
January 5, 2001